TRIGONOMETRIC IDENTITIES

Reciprocal and Quotient Identities:

$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

$$\sin\theta = \frac{1}{\csc\theta} \qquad \cos\theta = \frac{1}{\sec\theta} \qquad \tan\theta = \frac{1}{\cot\theta}$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta} \qquad \cot\theta = \frac{\cos\theta}{\sin\theta}$$

Cofunction Identities:

$$\sin\left(\frac{\pi}{2}-\theta\right) = \cos\theta \qquad \cos\left(\frac{\pi}{2}-\theta\right) = \sin\theta$$

$$\tan\left(\frac{\pi}{2}-\theta\right) = \cot\theta \qquad \cot\left(\frac{\pi}{2}-\theta\right) = \tan\theta$$

$$\sec\left(\frac{\pi}{2}-\theta\right) = \csc\theta \qquad \csc\left(\frac{\pi}{2}-\theta\right) = \sec\theta$$

Pythagorean Identities:

$$\cos^2\theta + \sin^2\theta = 1$$

$$1 + \tan^2\theta = \sec^2\theta$$

$$\cot^2\theta + 1 = \csc^2\theta$$

Odd-Even Identities:

$$\sin(-x) = -\sin x \qquad \cos(-x) = \cos x \qquad \tan(-x) = -\tan x$$

$$\csc(-x) = -\csc x \qquad \sec(-x) = \sec x \qquad \cot(-x) = -\cot x$$

Sum or Difference Identities:

$$\sin(u \pm v) = \sin u \cos v \pm \cos u \sin v$$

$$\cos(u \pm v) = \cos u \cos v \mp \sin u \sin v$$

$$\tan(u \pm v) = \frac{\tan u \pm \tan v}{1 \mp \tan u \tan v}$$

Double Angle Identities:

$$\sin 2u = 2 \sin u \cos u$$

$$\tan 2u = \frac{2\tan u}{1-\tan^2 u}$$

$$\cos 2u = \cos^2 u - \sin^2 u$$

$$\cos 2u = 2\cos^2 u - 1$$

$$\cos 2u = 1 - 2\sin^2 u$$

Half-Angle Formulas:

$$sin\frac{\theta}{2} = \pm\sqrt{\frac{1-cos\theta}{2}}$$

$$cos\frac{\theta}{2} = \pm\sqrt{\frac{1+cos\theta}{2}}$$

$$tan\frac{\theta}{2} = \frac{1-cos\theta}{sin\theta} = \frac{sin\theta}{1+cos\theta}$$

Product to sum formulas:

$$sinxsiny = \frac{1}{2}[\cos(x-y) - \cos(x+y)]$$

$$cosxcosy = \frac{1}{2}[\cos(x-y) + \cos(x+y)]$$

$$sinxcosy = \frac{1}{2}[\sin(x+y) + \sin(x-y)]$$

$$cosxsiny = \frac{1}{2}[\sin(x+y) - \sin(x-y)]$$

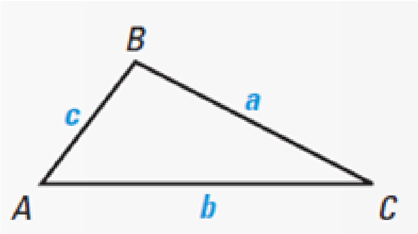
Sum to product formulas:

$$sinx + siny = 2sin\left(\frac{x+y}{2}\right) cos\left(\frac{x-y}{2}\right)$$

$$sinx - siny = 2cos\left(\frac{x+y}{2}\right) sin\left(\frac{x-y}{2}\right)$$

$$cosx + cosy = 2cos\left(\frac{x+y}{2}\right) cos\left(\frac{x-y}{2}\right)$$

$$cosx - cosy = -2sin\left(\frac{x+y}{2}\right) sin\left(\frac{x-y}{2}\right)$$



Law of Sines:

$$\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c}$$

$$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$$

Law of Cosines:

$$a^2 = b^2+c^2-2bc\cos A \qquad cos^{-1}\left(\frac{a^2-b^2-c^2}{-2bc}\right)=A$$

$$b^2 = a^2+c^2-2ac\cos B \qquad cos^{-1}\left(\frac{b^2-a^2-c^2}{-2ac}\right)=B$$

$$c^2 = b^2+a^2-2ba\cos C \qquad cos^{-1}\left(\frac{c^2-a^2-b^2}{-2ab}\right)=C$$

Area of Oblique Triangle

Heron's Area Formula: A = $\sqrt{s(s-a)(s-b)(s-c)}$, s = $\frac{a+b+c}{2}$

Area= ½ bcsinA, ½ acsinB, ½ absinC

Angle between two vectors: $cos\emptyset = \frac{u\bullet v}{\|u\|\|v\|}$ or $sin\theta = \frac{\|u\times v\|}{\|u\|\|v\|}$ **Unit Vector**: $\frac{u}{\|u\|}$

Complex numbers:

z=r(cosθ+sinθ*i*) a= rcosθ b= rsinθ r = $\sqrt{a^2+b^2}$ tanθ= $\frac{b}{a}$

$$z_1 \bullet z_2 = r_1r_2(\cos(\theta_1+\theta_2)+isin(\theta_1+\theta_2)$$

$$\frac{z_1}{z_2}=\frac{r_1}{r_2}(\cos(\theta_1-\theta_2)+isin(\theta_1-\theta_2)$$

Demoivre's Thrm: $z^n = [r(cos\theta + isin\theta)]^n = r^n(cos\mathrm{n}\theta + isin\mathrm{n}\theta)$

Roots of a complex number: $\sqrt[n]{r}(cos\frac{\theta+2\pi k}{n} + isin\frac{\theta+2\pi k}{n})$

Equation of a line: $x = x_1 + at$ Equation of a Plane: $a(x-x_1)+b(y-y_1)+c(z-z_1)=0$

$y = y_1 + bt$

$z = z_1 + ct$